vytran

LFS-4100
LARGE DIAMETER FIBER SPLICER

Filament Fusion Splicer for Standard, Large Diameter and Specialty Optical Fibers

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LFS-4100

A Stand-Alone Volume Optical Fiber Splicer

Vytran has leveraged the designs of its well-established LFS-4000 optical fiber splicer and GPX-3000 Series of glass processors, along with the application expertise gained via GPX systems, to create a new splicer, the LFS-4100. The LFS-4100 combines proprietary filament fusion technology, a high degree of user process control, and simple manufacturing operation, making it ideal for volume production of fiber assemblies. It comes equipped with an extensive applications library based on the years of application data that Vytran has generated using the GPX-3000 Series.

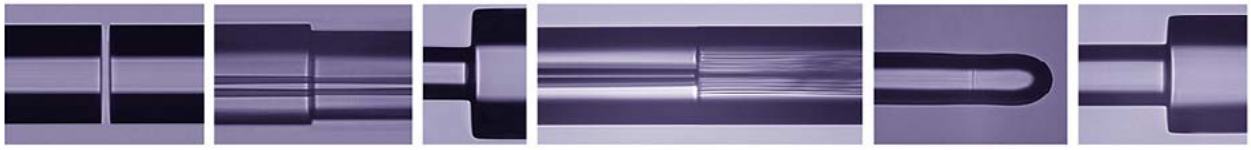
The LFS-4100 splices standard and specialty fibers up to 1.25 mm in diameter. It features the identical filament "furnace" assembly as the GPX-3400. This stable, high-temperature heat source allows maximum control of splice processing conditions. An embedded real-time control system and powerful machine level macro programming language allow the user to develop unique event-driven routines for fast and flexible process development. All user control is through Vytran's mature computer graphical interface.

Key Applications

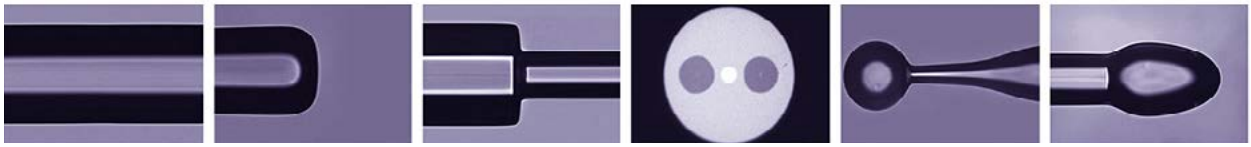
Splicing
Splice standard and specialty fibers with diameters up to 1.25 mm.
Standard - PM - Doped - PCF
Dissimilar fibers - Off-center fibers
LMA Fibers

Thermal Core Diffusion – Mode Field Adapters
Thermally diffuse the core dopants of a fiber, changing its waveguide characteristics. A controlled heat distribution profile along the fiber length enables adiabatic expansion of the mode field diameter.

Fiber Termination
Terminate all fibers (end caps, beam delivery fibers, lenses, etc.)



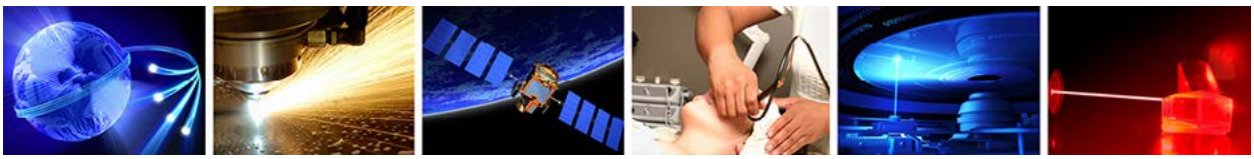
Splicing | Off-centered axis | End cap | PM to PM PCF | Probe | GRIN lens splicing



Splicing up to 1.25 mm | Fiber lens | Dissimilar fiber | PANDA | Ball lens | Custom probe

Vytran provides application development services. For other applications, please contact us.

Key Markets



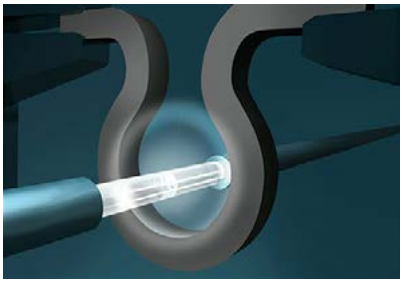
Fiber-based Instrumentation | Fiber Laser | Defense and Aerospace | Medical Device | Sensing | Research and Development

LFS-4100

Filament Fusion Technology for Precise and Consistent Splicing

Filament Fusion Provides Repeatable, High-Quality Splices

Vytran's filament fusion technology is a consistent and reliable method of making high-strength, low-loss splices. A precision resistive heating element supplies the exact amount of thermal energy necessary for fiber fusion. The heating element's size, shape and power delivery can be changed to suit the application, easily scaling to very large diameter fibers.



The filament furnace assembly can also be accurately moved along the length of the fiber, making many specialty processing applications possible, such as post-splice fire polishing for loss reduction and strength enhancement. These highly controlled conditions, in combination with constant power control circuitry, ensure repeatable performance splice after splice.

Fire Polishing Enhances Splice Strength

Vytran's patented fire polishing process significantly increases splice strength through a rapid post-fusion heat treatment of the splice region. When a fusion splice is made, silica evaporates off of the hot center region of the splice and condenses on either side of the joint where the fiber is cooler. The condensed silica deposits act as a surface flaw, lowering splice strength. Our fire polishing process removes or minimizes the deposits, thereby improving splice strength.

In addition, the fire polishing process provides core diffusion capabilities that can be used to adiabatically expand the mode field diameter of a fiber. Through this thermally expanded core (TEC) process, low-loss fusion splices can be achieved between markedly dissimilar fibers, such as those typically used in fiber laser applications.

Key Features	Benefits
Stable heat source	• Consistent fusion splicing • Consistent glass processing • Immune to ambient variation
Wide thermal dynamic range (a few 100°C to > 2500°C)	• Various fusion processes, splicing, M.F.A., end caps, etc. • Accommodates different fiber sizes (125 µm to 1.25 mm in diameter) • Works for different types of fiber materials (silica glass, software glass, e.g. phosphate glass) that require different treatment temperatures
Wide and uniform concentric heat zone	• Stable, repeatable, low-loss fusion splicing for wide range of fiber sizes
High fusion power	• Ideal for processing large fiber diameters
Fire polish	• Low splice loss • High strength splicing • High performance mode field adapting
Multiple filament designs	• Provides robustness and flexibility for different applications
Ease of filament replacement	• Quick set-up for different applications and fast maintenance

LFS-4100

Complementary Product Suite for Development through Volume Production

Splice Loss Estimation

The LFS-4100 uses Vytran's True Core Imaging™ technology for precise fiber core alignment prior to splicing. Because this technology provides a clear view of the fiber's inner core, an accurate estimation of splice loss can be achieved based on an analysis of the completed splice. Vytran has developed a proprietary algorithm that accurately calculates loss for splicing a variety of similar or dissimilar single mode fiber types with a high correlation factor.

End-View Imaging

The LFS-4100 features a unique End-View Imaging system for looking directly at the ends of the fibers prior to splicing. This is used in conjunction with high-precision rotary positioners for automated alignment of polarization maintaining (PM) fibers through either image-based or active feedback control. End-View Imaging is a powerful tool when working with PM fibers, which may have non-circular claddings or micro-structured cores.

Dual Screen Software Interface

The PC-based software features two complementary screens. The password-protected "development" screen gives users full access to all of the unit's functionalities for full process optimization. The "production" mode screen allows only basic system operator interface for efficient volume manufacturing.

A Complete Product Suite

Vytran's LFS-4100 splicer, GPX-3000 Series glass processor, LDC-400 fiber cleaver, and PTR-200 fiber recoaters and proof testers make up a suite of complementary products that support both early process development and volume manufacturing. This flexibility enables seamless transitions from the lab to the production floor for applications such as splicing fiber assemblies and creating fused components and fiber terminations for fiber lasers, medical devices, sensing and aerospace, among others.

Our LFS-4100, GPX-3000 Series and LDC-400 products share a fiber holding block to ensure fiber protection and precise positioning within each tool. LFS and GPX systems also feature extensive application libraries to help streamline processes from development to manufacturing.

LFS-4100

Key Features / Benefits

Filament fusion technology

- *High performance splices for fibers 125 µm to 1.25 mm*
- *Low-loss, high-strength splices*
- *Highly stable, consistent, and repeatable fusion process*
- *Uniform thermal treatment around the fiber*
- *Splice various specialty fibers, including PM fibers, non-circular cladding fibers or micro-structured fibers, and non-silica soft glass fibers*

True Core Imaging™ (Real-time imaging)

- *High resolution imaging system*
- *Automatic precision fiber core alignment*
- *Built-in fiber rotation alignment*

Fire Polishing

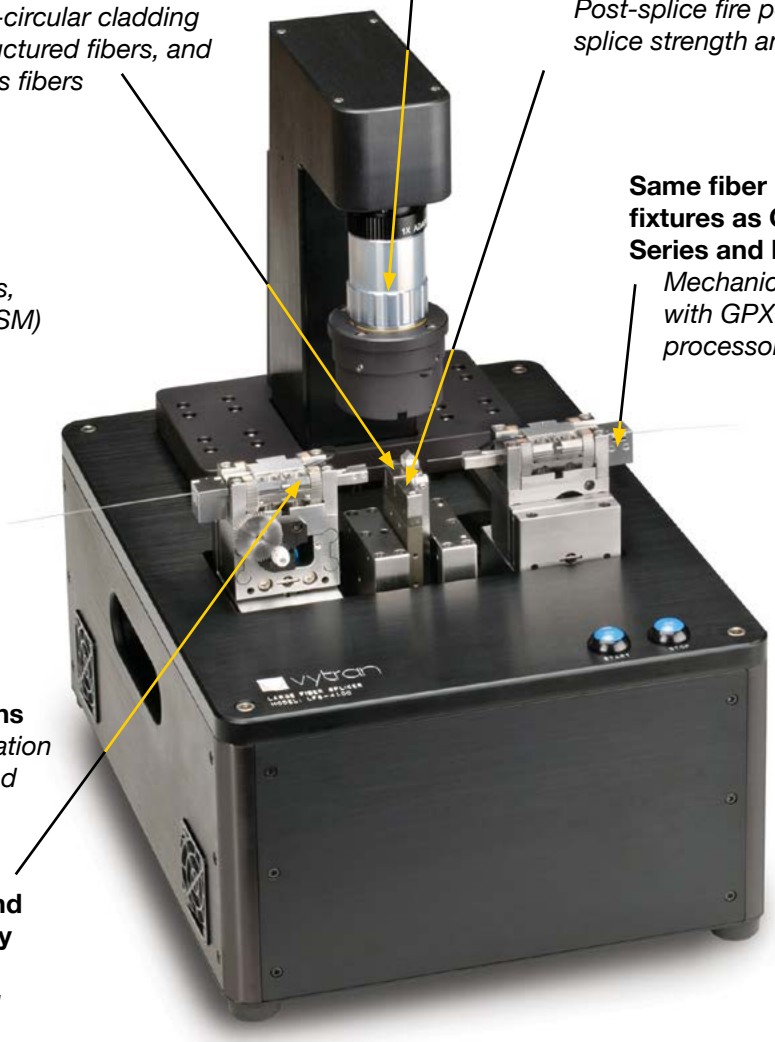
Post-splice fire polishing enhances splice strength and reduces loss

Same fiber holding/transfer fixtures as GPX 3300/3400 Series and LDC-400 cleaver

Mechanical compatibility with GPX 3300/3400 glass processors

Other applications

Fabrication of mode field adapters, couplers (MM and SM) and end caps (with LDC-400 cleaver)

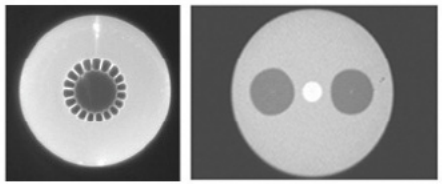


Library of Applications

Comparable application library to established GPX products

End-View Imaging and high-resolution rotary positioners

Automated splicing alignment for PM fibers, dissimilar fibers, off-centered fibers



End-View Imaging

LFS-4100 Specifications

Fiber Type Non PM	MM, SM, PCF, LMA, circular, non-circular, silica, soft glass (Call factory for your type)
Fiber Type PM	Panda, Elliptical, Bow-Tie and many others (call factory for your type)
Max. Fiber Cladding Diameter	1.25 mm
Fusion Method	Filament Fusion
Filament Temperature Range	Room temperature to > 3,000°C
Typical Splice Loss	0.02 dB for SMF (ITU-T G.652)
Loss Estimation (1)	Included (Proprietary method based on coupled mode theory)
Typical Splice Strength	>250 kpsi for SMF (ITU-T G.652) using LDC-400 or appropriate fiber preparation equipment
Strength Enhancement	Included - Fire Polish
Polarization Cross-Talk	Panda > 35 db, Others > 30 dB
Fiber Side Viewing	Included - True Core Imaging™
Fiber End Viewing	Included for PM alignment and for fiber facet inspection
Fiber Alignment Method	Manual or fully automated
Fiber Inspection and Measurement (2)	
End face inspection	Inspection via display
Cleave angle	Included - Automatic measurement
Splice loss estimation	Included - Automatic measurement
Active power alignment	Included
Furnace “Z” Movement	15 mm from home position (3)
Max. Fiber “Z” Movement	12 mm
“Z” Movement Resolution (4)	0.2 µm
X-Y Fiber Positioning Resolution (4)	0.02 µm
Rotation Alignment	Fully automated and manual
Rotation Drive Resolution (4)	0.02°
Rotation Travel	190°
PC Control and Proprietary Software	Included
Mouse	Included
GUI	One Step Splice™ in Operator Mode - Process Development Mode with password protection
Applications Software	
Splice Files	Built in library of most common fibers - Very large library available (contact Vytran)
Splice Memory	>> than 10,000 Splices
Monitor Features	High resolution full color (1024x768)
Core Applications	Low and high temperature glass splicing; PCF processing; creating end caps, fiber lenses, capillary tubing, many others - Please contact Vytran
Engineering Services	For more than 24 years Vytran has developed a library of glass processing applications. Please contact us about our engineering services and guidance on your specific application.
Installation and Training	Included - 3 days
Safety	No need of laser safety requirements
Physical	
Size	9.0˝ (W) x 12.5˝ (D) x 5˝ (H) (230 x 320 x 130 mm)
Weight	29 lbs, 13 kg
Power	External power supply unit, universal input: 90-240 VAC, 47-63 Hz, single phase
	LFS-4100 input: 12V and 48V DC 1OA
	PC input: 115 or 230 VAC, 47-63 Hz, single phase
Gas supply	Argon, Zero grade at 12 PSIG
Environmental	
Operating temp range (°C)	15 to 40°C
Operating pressure range	From sea level to 2000m
Operating humidity range	0 to 75% non condensing
Storage temp range (°C)	From -20° to 60°C
Storage humidity range	0 to 90% non condensing
Usage condition	Fiber optic manufacturing environment
Shock	Transportation across world in cargo plane

LFS-4100 Specifications cont.

Accessories included	
	Tool kit - Argon regulator
Filaments	8 pieces of replacement filaments: (4pcs) GF-1.0-1.0-0.46-V2-16 (4pcs) GF-1.5-2.0-0.75-V4-16
Inserts	Five (5) sets of bottom inserts: (2pcs) FHB-97-250 (2pcs) FHB-97-400 (2pcs) FHB-97-500 (2pcs) FHB-97-750 (2pcs) FHB-69-1000/1250 Three (3) sets of top inserts: LDC-15-0000 LDC-15-0500/0750 LDC-15-1000
Transfer clamp GPX-3000/LDC-400/200	Included
Options	
Combiner/coupler packaging fixture	Optional
LDC-400	Fully compatible mechanically (including LDC-200 family)
Tutorials	Vytran offers a large range of customized training and tutorials at our application centers (New Jersey - UK - Germany and China)

(1) True Core Imaging™ for accurate loss estimation
(2) CCD-based imaging system
(3) Max travel with fiber holding block parked
(4) Stepper motor controlled

Related Products:

LDC-400 Large Diameter Cleaver
Fully automated precision cleaver for standard, large-diameter and specialty fibers.
www.vytran.com/product/LDC-400

PTR-200-XLR and PTR-200-MRC Fiber Recoaters
Extended-length and standard manual recoaters that restore acrylate coating to stripped fiber.
www.vytran.com/product/ptr-200_series

GPX-3000 Series Glass Processors
Versatile glass processing systems for creating splices, combiners, tapers, couplers, end caps and other fused components on a wide range of optical fibers.
www.vytran.com/product/gpx-3000_series

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